Anticipating emerging infectious disease epidemics

1-2 December 2015
Geneva, Switzerland

World Health Organization
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Back to the future: Learning from the past

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WHO INFORMAL CONSULTATION

Anticipating emerging infectious disease epidemics

Background and purpose

The world stands at a critical juncture in public health. Epidemics of infectious diseases are able to disrupt many spheres of human existence and the impact can be felt across the globe. To better prepare for and respond to those threats, it is imperative that we make fundamental changes to how we understand them. The significant ways in which the world has changed means that it is not enough to just implement traditional measures such as quarantine and isolation for epidemic control. We must move beyond the traditional and find innovative approaches that are relevant for today’s world and, more importantly, that of the future.
The specific objectives of this consultation are:

- To create a forum for discussion by bringing together multi-disciplinary experts in a forward-thinking exercise on how to better anticipate and prepare for epidemics;
- To engage with a wide range of expertise and experience in order to shape international collaboration to tackle future infectious risks; and
- To identify approaches to improve detection, early analysis and interpretation of factors that drive emergence and amplification of infectious disease epidemics.

Recent major public health crises such as SARS, the H1N1 2009 Pandemic and Ebola in West Africa have unequivocally demonstrated the critical importance of the many non-biomedical factors that influence the emergence and spread of epidemics. We must also accept the fact that such epidemic and pandemic diseases will continue to threaten humanity. Following the re-emergence of H5N1 and the spread of SARS, WHO Member States adopted the revised International Health Regulations (IHR 2005). After the recent Ebola crisis in West Africa, the global community is similarly looking at the necessary mechanisms to better protect humankind from devastating epidemics. We have the benefit of hindsight and an unprecedented opportunity to revamp our collective approach to preventing and controlling epidemics so that we can mitigate their impact.

As a forward-thinking exercise, this meeting will engage a broad range of global experts from multi-disciplinary fields along with key stakeholders and partners to understand and delineate the elements within which epidemics of the future will occur. The ideas and deliberations will elucidate the drivers of emergence and amplification of infectious disease outbreaks. The outputs of the consultation will guide and inform future preparedness; calibrate response and R&D efforts; and reinforce global health security mechanisms.
From 2003 to 2009, most countries in the world had developed preparedness plans against a severe influenza pandemic due to H5N1 virus. However, in 2009 the first pandemic of the 21st century due to H1N1, did not have the characteristics anticipated. One of the challenges was for risk communication in the age of social media and rapid spread of rumors via the web. Better anticipation of the impact of new communication patterns would have improved our risk communication and led to a less disruptive and confused response.

Our experience with Ebola outbreaks in Central Africa in the last 40 years demonstrated that we could successfully contain them within a few months. In contrast, the West African Ebola outbreak could not have unfolded more differently. The analysis of a number of social and economic factors that are not usually part of routine epidemiologic evaluation could have helped anticipate the evolution and calibrate the response at the start if only the possibility of an “unlikely scenario” had shaped the approach to analysis.

We have a golden opportunity to evaluate how these epidemics evolved and to assess the contextual drivers that we could have addressed that might have mitigated the impact. These elements are known, for the most part, they are not considered critical and therefore not systematically taken into account in designing the response.

This session will explore:

- What are the critical lessons to be learned from major recent epidemics?
- What signals and information should we have anticipated that made “routine” events extraordinary?
- How can we enhance our preparedness and response by thinking outside the box?

“We have a golden opportunity to evaluate how these epidemics evolved and to assess the contextual drivers that we could have addressed that might have mitigated the impact.”
Topic 1 – Ebola West Africa: drivers and lessons learned (many elements)
Seven countries in Africa had Ebola outbreaks in 2014-15. In three countries, there were devastating events; in the other four the spread was contained. What allowed countries that were able to control the virus do so, compared to those that could not? What factors were important for anticipating the evolution of Ebola in Africa? What lessons must the world and all nations take into account for future epidemic response?
Oyewale Tomori (Nigeria)

Topic 2 – Multidisciplinary response: strengths and challenges (many perspectives)
Different partners exist, including non-health sector ones, and they each bring different points of view, perceptions of the risk, and solutions to address the problem. Could we have an agreed and viable assessment mechanism? How can we maximize and harness all the involved sectors to collaborate for outbreak response?
Ronald Waldman (George Washington University)

Topic 3 – New perspectives on outbreak response after SARS in Canada (many connections)
SARS was the first major international event of this century which showed that any local crisis can become an international problem and that no country can consider itself isolated from the impacts. Is it possible to have a world of zero risk? How should we learn to live with dangerous pathogens that have pandemic potential?
Ronald K Saint John (Canada)

Topic 4 – A mild pandemic: critics and anticipation (many conflicts, criticisms)
There are medical interventions such as vaccines and antivirals available for influenza. Their use has raised a number of criticisms and suspicions in many affected countries with parliamentarian investigations after the crisis. Could we have anticipated the scepticism around those lifesaving interventions (vaccination, drugs)? What should be done differently in the future?
John Watson (UK Public Health England)

Topic 5 – The role of NGOs and health sector partners (many actors)
Many different institutional actors including NGOs, particularly those that are faith-based, are important providers of health care in poorer parts of the world. How can these key humanitarian organizations contribute to preventing and controlling epidemics of the future?
Sean Casey (International Medical Corps)

Some questions for the audience
- What are the drivers of emergence and amplification that can turn an outbreak into an epidemic?
- What critical drivers need to be integrated into the risk assessment?
The eco-systemic approach is gaining momentum as a more holistic model to describe the emergence of infectious diseases by building on multidisciplinary expertise integrated for outbreak management. “One Health” concepts elucidate the intermingled and dynamic relationship between humans and their environment, including animal domestic and wild life. They are critical pathways in pathogen emergence and it is vital that we build on this vast area of study and better incorporate the knowledge into anticipating emerging threats.

The one pathogen / one disease biomedical model is the current common global paradigm for understanding infectious diseases. New genomic technologies have highlighted the complexity of the microscopic world. Recent knowledge acquired on the gut microbiota sheds new light on the mechanisms that can turn a microorganism into a human pathogen. This knowledge may change the preventive and therapeutic approaches for a number of human diseases.

Historically, the study of the invisible world of pathogens has made leaps from germ theory and miasma, to identification of microorganisms with the microscope leading to the development of counter measures such as antibiotics and vaccines. The biological origin of epidemics through the centuries has now reached another milestone – the human microbiome and the study of microbiota. The perspectives from this relatively new science need to be taken into account in dealing with modern day epidemics.

This session will explore:
- How can we better use the human-animal interface to anticipate and respond to emerging infectious diseases?
- What could be the impact of the new infectious disease paradigm (microbiota) on the understanding and control of outbreaks?

“ ‘One Health’ concepts are critical pathways in pathogen emergence and it is vital that we build on this vast area of study.”
About 70% of emerging human pathogens are from animal origin. How can we predict emergence of new human pathogens that come from animals? What does this mean for becoming better prepared at the human-animal interface?

Monique Eloït (World Organization for Animal Health [OIE])

How can public health measures applied in the animal sector protect human health? What are their consequences on socio-economic-political levels? What have been some of the successful impacts?

Julio Pinto (Food and Agriculture Organization of the UN [FAO])

The increasing knowledge on the microbiome changes our understanding of the internal human ecosystem and its impacts on research for new therapeutic approaches. What could be the implications of this science for disease control in managing the balance of multiple microorganisms versus the invasion of one pathogen?

Nadia Khelef (Institut Pasteur International Network [RIIP])

We are just beginning to explore the respiratory microbiome. What remains to be learned and how can we apply state-of-the-art knowledge to identify interventions for preparing for and controlling future respiratory epidemics?

David Murdoch (University of Otago, New Zealand)

Researchers have explored the human-animal interface to better predict the emergence of new pathogens. What are the lessons learned so far? How can and should ecosystem surveillance evolve?

Dennis Carroll (USAID)

Some questions for the audience

- How can we holistically and systematically apply our knowledge on the human-animal interface and the microbiome to mitigate epidemics?
- What concrete steps can be implemented to anticipate emergence and prevent amplification of pathogens?
The recent advances in science and technology and the tools they have generated have become part of our daily life. This trend continues to accelerate as the 21st Century progresses. These novel advances have led to many changes in our abilities to detect and respond to epidemic threats but these have not always been taken to scale or utilized to their full potential.

New technologies and techniques present greater opportunities for the future but are also subject to populations’ perception and acceptance as the accessibility and use of technology increase. In order to maximize potential impact these technologies must be adapted to the contexts within which they are expected to work.

This session will explore:

- How new scientific advances and technologies can impact surveillance, detection and control of emerging pathogens?
- What is the impact of increased accessibility, availability and visibility of technologies on risk perception and how should public communication strategies be adapted to make them successful?

“New technologies and techniques present greater opportunities for the future but are also subject to populations’ perception and acceptance as the accessibility and use of technology increase.”
**Topic 1 – What’s new for surveillance and detection?**
New technologies, including molecular methods, are used to investigate and understand outbreaks. How can the dynamic of an old epidemic disease such as cholera be understood with the use of novel technologies?

*Nur A Hasan (COSMOSID)*

**Topic 2 – Advances in biology and their applications**
The recent advance in synthetic biology changes the risk of epidemics. Viruses can be (re)created and made even more virulent and dangerous. What are the implications for response and communication? On the positive side, what are the applications of synthetic biology for prevention and control of infectious diseases?

*James Ajioka (University of Cambridge)*

**Topic 3 – What’s new in diagnostics?**
Laboratory confirmation is essential for the diagnosis of infectious diseases. New technologies make laboratory confirmation faster, easier and cheaper. What advances can we expect for the near future? How can we transfer these new techniques and tools to the field, especially extending their use in resource-poor settings?

*Mark Perkins (Foundation for Innovative New Diagnostics [FIND]*)

**Topic 4 – Risk perception and community engagement**
Modern communication technologies have facilitated rapid access to epidemic information. How does this influence the risk perception at community level? How do modern and traditional communication means compete or synergise to enhance community engagement for the response to epidemics?

*Amanda McClelland (International Federation of the Red Cross [IFRC]*)

**Topic 5 – Communicating in the 21st Century**
Communities are key actors for the success of the response provided they have access to necessary and actionable information. However, multiple information sources can lead to cacophony and confusion. What are the new tools and techniques for improved communication for outbreaks in today’s world?

*Barbara Bentein (UNICEF)*

### Some questions for the audience
- How can we best use new technologies to rapidly detect, communicate and respond to epidemics?
- How can those tools help to better engage communities and other actors in outbreak response?
Moderator: Brian McCloskey

Our information-driven world is characterised by the sheer volume, velocity and variety of data; so called “big data”. To embrace the unprecedented opportunity this presents, we need appropriate strategic and scientific insights in order to adequately exploit them. Not all data that are collected need to be used but by capturing meaningful signals, and interconnecting and analysing them we can improve our ability to anticipate the evolution of an outbreak.

The interpretation and analysis of various, multi-layered data types can lead to better decision making if we use the right and most relevant causal models and scenarios.

The availability of a huge amount of information also requires concrete actions by coordinated partners to make the most of this core resource. This is indeed one of the biggest revolutions of the 21st Century that has been made possible by worldwide interconnectivity.

This session will explore:

- How can real-time information be better used for timely and relevant responses?
- Forecasting: what can public health learn from other sectors?
- How can big data approaches be applied to enable epidemic anticipation?

“The availability of a huge amount of information also requires concrete actions by coordinated partners to make the most of this core resource.”
Topic 1 – Modelling outbreaks: pros and cons
Mathematical modelling is increasingly used for epidemic analysis. What lessons have we learned for response from modelling past outbreaks? How can we best use modelling for anticipation and response in the future given the varied quality and quantity of critical data elements?
Christl Donnelly (Imperial College, London)

Topic 2 – Learning from successes in meteorology
Weather forecasting accuracy has vastly improved in the past 25 years. How did this progress occur, what were the critical milestones and advances, and what techniques and advances could be transferred to forecasting outbreaks?
Paolo Ruti (World Meteorological Organization [WMO])

Topic 3 – Use of big data to anticipate epidemics and their evolution
The use of big data approaches for detecting early signals of emergence of epidemic diseases is a growing area. What kinds of data are we currently missing and how can we better mine them? What is the future of big data applications in outbreaks and what are the challenges?
Kamran Khan (University of Toronto)

Topic 4 – Learning from the insurance expertise
The insurance sector has mastered the assessment of a variety of risks to guide their investment strategies. The scenario-based approach is often used to frame the future. What could the value of this approach be for anticipating epidemic risks?
Cecile Wendling (AXA Insurance Company)

Some questions for the audience
- How do we capture, collect and optimally analyse data on the drivers and amplifiers of epidemics?
- What can the health sector learn from other sectors that are further ahead in anticipating risks?
Recurrent outbreaks and out-of-control epidemics in vulnerable areas of the world are a clear indication of lack of economic and social development as evidenced by poor health systems and infrastructure. But even in developed countries with well-run health systems, outbreaks can be amplified and infectious threats, such as antimicrobial resistance and nosocomial infections, as well as human behaviour such as resistance to vaccination, continue to present challenges.

The health systems of the future must take into account the potential for emerging infectious threats. Health systems (particularly health facilities and health actors) play a critical role in reducing morbidity and mortality on the one hand but on the other, may also be the source of amplification of epidemics.

This session will explore:

- How can the health systems of the future minimise the risk of amplifying epidemics?
- What kinds of innovations in medical technologies and patient care will improve epidemic control?
- What kind of research is needed for the 21st Century to better address the challenge of emerging pathogens?

“Health systems play a critical role in reducing morbidity and mortality on the one hand but on the other, may also be the source of amplification of epidemics.”
Topic 1 – Clinical practices and emerging diseases
MERS-CoV in Saudi Arabia has produced a number of outbreaks in hospital settings. What are the lessons learned and what are the solutions for clinical practices in various health care settings three years into the emergence of this pathogen?
Abdullah M Assiri (Kingdom of Saudi Arabia)

Topic 2 – Systemic view of infections in health care facilities
The organization of health care facilities can facilitate the spread and amplification of dangerous pathogens. What must we do to address the growing threat of emergence from within health facilities in terms of building, designing and managing health facilities and health systems of the future?
Abdel Ghafur (Apollo Hospital, Chennai, India)

Topic 3 – Patient–doctor relationship in the age of the Internet
During outbreaks, the relationship between patients and health providers is a critical element for implementation of medical countermeasures. The internet gives patients access to vast amounts of medical information which has a significant impact on the patient-provider relationship. What is needed to enhance the abilities of health care providers to maintain a trustful relationship with their patients during outbreaks?
Hélène Lepetit (Institut des Mamans [IDM])

Topic 4 – Impact of strengthening the overall health system
Elements of the health systems need to be better aligned with appropriate measures to prevent outbreaks and the spread of epidemics. How can the health system as a whole contribute to mitigating the impact of epidemics? What are some of the critical issues to be considered as we move towards the health system of the future, particularly in low-resource settings?
Idrissa Sow (Mauritania)

Some questions for the audience
- What are the elements that the health system of tomorrow must have in place to prevent the amplification of epidemics and mitigate their impact?
- How can we change routine clinical practices including adaptation to cultural beliefs and practices to better prevent and manage infections?
The world has changed dramatically in the last half-century with globalisation, urbanisation, migration, the internet, and climate change as the most obvious manifestations. The socio-economic and political developments of the 21st Century call for newer ways of thinking about outbreaks and epidemics, especially the implementation of traditional measures for outbreak containment. Better alignment of tried and tested public health measures with our modern society is critical to prevent emergence and amplification of future epidemics.

A holistic approach, combining biomedical and social considerations needs to be applied as the gold standard for controlling outbreaks. In addition, public health measures must not only be reactive but also preventive. Assessments, therefore, require a long-term view in order to address the fundamental determinants that lead to outbreaks occurring in the same hotspots and linked to core development issues.

This session will explore:
• How can we incorporate socio-economic and political determinants into outbreak control?
• How can we modernize “traditional” control measures (isolation, quarantine, culling etc) in today’s world?
• What are the politics and political challenges of responding to escalating outbreaks?

“A holistic approach, combining biomedical and social considerations needs to be applied as the gold standard for controlling outbreaks.”
Topic 1 – Evolution of health security concepts
The concepts around health security have evolved rapidly in the recent past. What are the important elements we must be aware of in preparing for a secure health future for the world?
Ali S. Khan (University of Nebraska)

Topic 2 – Revisiting traditional containment measures
Borders are becoming increasingly porous. Controls at points of entry have proven to be difficult in many international epidemics. How can the application of traditional measures (quarantine, isolation) be adapted in our modern, highly mobile world?
Marty Cetron (US Centers for Disease Control and Prevention [CDC])

Topic 3 – Managing epidemics in urban settings
Urbanisation and the increasing number of megacities is a prominent feature of this century. What are the specific risks for emerging epidemic diseases in urban settings, particularly in mega-cities and in their peri-urban areas in poorer parts of the world?
Hayley MacGregor (Institute for Development Studies [IDS])

Topic 4 – Epidemics and tourism
International tourism involves millions of people every year, increasing the mixing and spread of potential pathogens. How can health and tourism sectors work together to concretely address challenges of international threats?
Dirk Glaesser (UN World Tourism Organization [UNWTO])

Topic 5 – Political perspectives of global risk
All epidemics carry a political dimension. With the globalisation of economic and political interests what are the challenges faced by national level politicians when dealing with an epidemic crisis? How does it impact decision-making and public communication?
Fabienne Keller (France)

Some questions for the audience
• What are the key drivers of epidemics in today’s interconnected global ecosystem and the evolving social habitat?
• How can we better engage with today’s societies for preparedness and response to epidemics?
• What public health measures should we adapt and how do we move from a biomedical approach to a more holistic one?
Session 7
Convergence and looking forward

Summary of the meeting deliberations
Sylvie Briand, Director
Department of Pandemic and Epidemic Diseases, WHO

WHO’s R&D Blueprint for epidemic preparedness
Marie-Paule Kieny, Assistant Director General
Health Systems Innovation, WHO

The changing landscape for WHO: Global ecosystems, partners and mechanisms
David Nabarro
UN SG Special Envoy on Ebola